WHAT IS CLAIMED IS:

1. A method for localization of fluorescence in a scattering medium, the method comprising the steps of:

illuminating the scattering medium with an excitation light to excite the fluorescence;

modulating a portion of the emitted light from the fluorescence within the scattering medium using an ultrasonic pulse;

detecting the modulated optical signal at a surface of the scattering medium.

2. The method as in claim 1, further comprising the step of reconstructing a spatial distribution of the fluorescence in the scattering medium from the detected signal.

3. The method as in claim 1, wherein the modulating step is performed by an ultrasonically induced gradient of refractive index.

4. The method as in claim 2, wherein the reconstructing step further comprises scanning a volume of the scattering medium with an ultrasonic beam and detecting the modulated optical signal for each scanning location.

5. The method as in claim 1, wherein the illumination with the excitation source is intensity modulated sinusoidally at a predetermined frequency.

6. The method as in claim 1, wherein the illumination with the excitation source is intensity modulated sinusoidally at time-varying frequencies.

7. The method as in claim 1, wherein the illumination with the excitation source is pulsed at a predetermined repetition rate and pulse width.

8. The method as in claim 1, wherein the illumination with the excitation source is in continuous wave mode.

9. The method as in claim 1, wherein the ultrasonically induced pressure gradient is shaped as a single ultrasonic focal spot, an array of focal spots situated along a single line, an elongated linear ultrasonic focal region oriented along an optical source-to-receiver axis, a superposition of two or more ultrasonic beams to form an acoustic interference pattern at the same frequency or a superposition of two or more ultrasonic beams at the different frequencies.

10. The method as in claim 1, wherein the detecting step of the modulated optical signal is performed by a homodyne detection method wherein a gain of the optical signal is modulated at the ultrasonic frequency, and a phase between the optical gain and the ultrasound is swept over a range of angles.

11. The method as in claim 1, wherein the detecting step of the modulated optical signal is performed by a heterodyne detection system wherein a gain of the optical signal is modulated at a frequency that is different that the ultrasound frequency, and an amplitude of the signal at the side lobes is measured.

12. The method as in claim 1, wherein the detecting step of the modulated optical signal is performed by a gated detection method that integrates the optical signal at a particular phase in the ultrasonic modulation over many acoustic cycles and integrates the optical signal at one or more different phases over many acoustic cycles, wherein the modulated optical signal can be extracted by comparison of the integrated signals.

13. The method as in claim 1, wherein the detecting step of the modulated optical signal is performed by a double cross correlation technique that performs a correlation analysis of the detected optical signal against the illumination input signal and the ultrasonic input signal to measure an amplitude of the detected signal for optimal noise rejection.

14. A method for localization of fluorescence in a scattering medium, the method comprising the steps of:

illuminating the scattering medium with an excitation light to excite the fluorescence;

modulating the excitation light using an ultrasonic pulse;

detecting a modulated optical signal emitted from the fluorescence at a surface of the scattering medium.

15. A system for localization of fluorescence in a scattering medium comprising:

an excitation light source for illuminating the scattering medium;

a fluorescent dye within a preselected region of the scattering medium for absorbing and emitting light in the NIR (near infrared) region of the light spectrum;

an ultrasonic scanning system for generating ultrasonic pulses, wherein the ultrasonic pulses modulate the emitted light from the fluorescent dye; and

an optical detection system for detecting the modulated light.

16. The system as in claim 15, further comprising a data processing system acquiring the detected optical signal and generating a spatial distribution of the fluorescence in the scattering medium based on the detected optical signals.

17. The system as in claim 15, wherein the excitation light source is a laser, laser diode, light emitting diode (LED) or a lamp.

18. The system as in claim 15, wherein the fluorescent dye is Indocyanine green (ICG), a member of the Cy family of dyes, IR-78 dye or a fluorophore that emits in the NIR region of light.

19. The system as in claim 15, wherein the ultrasonic scanning system is a single- ultrasonic transducer that is scanned over the preselected region of the scattering medium.

20. The system as in claim 15, wherein the ultrasonic scanning system is a phased array of single element ultrasonic transducers that are scanned over the preselected region of the scattering medium.

21. The system as in claim 15, wherein the optical detection system further comprises:

a light collection and delivery system for collecting light emitted;

at least one optical filter for filtering the light and allowing transmission of fluorescent emission; and

a detector for converting optical signals to electrical signals capable of being read by the data processing system.

22. The system as in claim 21, wherein the light collection and delivery system includes at least one optical fiber for delivering collected light from the scattering medium to the detector.

23. The system as in claim 21, wherein the detector is photodetector, photomultiplier tube (PMT), image intensifier, charge-coupled device or an array of photosensitive elements.

24. An imaging system for localization of a preselected object in a scattering medium comprising:

an excitation light source for illuminating the scattering medium;

a fluorescent dye injected into the preselected object for absorbing and emitting light in the NIR (near infrared) region of the light spectrum;

an ultrasonic scanning system for generating ultrasonic pulses, wherein the ultrasonic pulses modulate the emitted light from the fluorescent dye;

an optical detection system for detecting the modulated light; and

a data processing system acquiring the detected optical signal and generating a spatial distribution of the preselected object in the scattering medium based on the detected optical signals.